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1928

FEDERATED MALAY STATES.

ANNUAL REPORT

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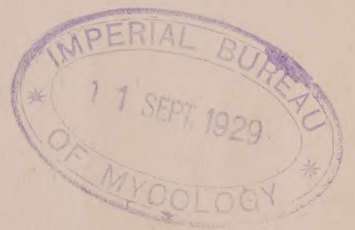
DEPARTMENT OF AGRICULTURE,
S.S. AND F.M.S..

FOR THE YEAR

1928

BY

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FEDERATED MALAY STATES.

ANNUAL REPORT OF THE SECRETARY FOR AGRICULTURE, STRAITS SETTLEMENTS AND FEDERATED MALAY STATES, FOR THE YEAR 1928.

STAFF.

The establishment of the Department of Agriculture, excluding the Secretary for Agriculture, comprised 43 European officers. Of these, 30 were on the Research Staff, one was Agricultural Instructor and 12 were on the Field Staff, the latter including three in the Colony and one seconded for service in Johore. Five of these appointments were not filled, while in addition two officers were seconded, one for service with the Rubber Research Institute of Malaya and another in the Co-operative Societies Department. Details are given in Appendix A of this report.

ADVISORY COMMITTEE.

2. The Advisory Committee at the close of the year was composed of the following members:

The Secretary for Agriculture (*Chairman*);
Raja Abdul Aziz, C.M.G., Raja Muda of Perak;
Mr. L. P. Jorgensen;
Mr. M. J. Kennaway;
Mr. J. Melville;
Mr. G. S. Reis, B.Sc. (Agric.);
Mr. W. A. Stanton;
Secretary to Committee, Mr. D. H. Grist.

Mr. J. W. Campbell also served on this Committee for the first half of the year.

INTRODUCTION.

3. The year has been characterised by an increasing and in some cases very practical interest in the cultivation of crops other than rubber. This interest has undoubtedly been stimulated to a considerable extent by the fall in the price of our most important agricultural product, but it appears to be by no means ephemeral and to give promise of possible future developments that may prove of considerable importance to this country.

The large number of enquiries received by this department have related especially to the cultivation of oil palm, pineapples, coffee, tea and tuba root.

Attention may again be drawn to the shortage of supplies of pepper. The resulting high price at present obtainable on the market should provide an attractive profit to planters experienced in pepper cultivation.

Problems of soil conservation and treatment are receiving consideration, with the results that the old standard practice of clean weeding is tending to disappear and that knowledge concerning the nature and uses of the best types of cover plants is spreading.

MAJOR CROPS.

RUBBER.

4. GENERAL.—The announcement in February that restriction of output would cease on the 31st October caused a sharp drop in the price of rubber at the time and gave rise to much uncertainty as regards the trend of prices after removal of restriction. Unfavourable market conditions were generally predicted and, although these did not materialise, there was a tendency on small holdings to accumulate as large stocks of rubber as possible in the interval in order to compensate for the anticipated further fall in price. Since the abolition of restriction, a decline in the standard of maintenance of small holdings has become apparent, while disease control on such properties has become increasingly difficult to enforce.

A new development during the latter half of the year was the creation, by an American Corporation interested in the manufacture of rubber seed oil, of a market for rubber seed in this country. All the seed purchased was exported to Medan, in Sumatra, where the Corporation's decorticating plant is situated. In order to comply with the regulations governing the import of rubber seed into the Netherlands East Indies the consignments of seed had to conform to a high standard of quality and be covered by certificates of freedom from pests and diseases issued by this department. Unfortunately the necessity for exporting only seed which would conform to the required standard was not always realised, with the result that some consignments had to be refused the required certificates. Valuable experience has, however, been gained during this first season and it is hoped that this will lead to further developments and possibly to the erection of a decorticating plant in Malaya.

The total exports of rubber seed for the year amounted to 7,905 tons valued at \$246,940. Practically the whole of this supply was intended for oil production. The Corporation offered \$22 per ton of seed, free on rail. An enquiry by this department showed that on most estates the collection of seed was treated as a spare time occupation for the labour force and that the average cost of collection and packing amounted to \$11 per ton. Consequently, provided that the estate was not very distant from a railway or a port, a good profit was obtained, while the spare time occupation was of considerable value to the labour force, especially where Indians were employed.

The interest now evinced by planting companies in modern developments for obtaining high yielding rubber trees is reflected in the large quantities of budwood, budded stumps and selected seeds imported from Java and Sumatra throughout the year. The actual quantities recorded were 31,055 metres of budwood, 25,353 budded stumps and 387,110 selected rubber seeds. Small quantities of seed and budwood have also been exported.

5. DISEASES AND PESTS.—MOULDY ROT DISEASE (*Ceratostomella fimbriata*). In confirmation of past experience it was observed again during the year that the incidence of this disease is dependent on weather conditions. During the first half of the year, which was characterised by a long spell of hot dry weather, only small sporadic attacks in a few centres were recorded, but, with the advent of wet weather in the second half of the year, reinfection was general in all areas previously attacked and the fungus spread to a few new localities in most parts of the Peninsula.

BLACK STRIPE (*Phytophthora* spp.).—During the last quarter of the year a widespread, but not unusually virulent, outbreak of this disease required attention in Southern Perak.

COLLAR PATCH CANKER.—The somewhat rare form of patch canker occurring on the collar of rubber trees and attributed to a species of *Pythium* was present on one estate during the year. Treatment, which included the destruction of some of the attacked trees, was quickly undertaken and the disease was effectively controlled.

Attacks of most of the well-known diseases and pests of rubber, such as pink disease (*Corticium salmonicolor*), root diseases, and white ants (*Coptotermes gestroi*) were recorded, but call for no particular comment.

PADI (RICE).

6. AREA AND CROPS.—The area planted with "wet" rice for the 1928 harvest was stated to be 154,236 acres in the Federated Malay States and 631,301 acres in the whole of Malaya. The corresponding crops reaped are given as 28,835,228 gantangs (gallons) and 130,914,295 gantangs, respectively. The Peninsula also produced 4,212,746 gantangs of "dry" padi from 31,769 acres. Statistics of the crop are given in Appendix B.

As compared with the figures for the season 1926-27, those for 1927-28 show a decrease of 4,626 acres in the area planted with "wet" padi in the Federated Malay States, but an increase in crop of 7,410,563 gantangs. The yields in the season 1926-27 were abnormally low owing to the damage done by the floods. Half the recorded increase in yield during the 1927-28 season came from Krian district alone, the remainder of Perak and the State of Pahang being responsible for the other half. Practically all the decrease in acreage planted occurred in the State of Selangor.

As regards the whole Peninsula, the planted area increased in 1928 as compared with that of 1927 by 72,628 acres of which Kelantan was responsible for 58,425 acres and the Colony for 2,915 acres. The crop increased by 12,872,028 gantangs of which the Federated Malay States and the Colony were together responsible for approximately 10½ million gantangs. The Unfederated Malay States accounted for the balance, an increase in crop of nearly six million gantangs in Kelantan being offset by a decrease in Kedah and Perlis of about five million gantangs.

In Penang, Malacca and Pahang the crops obtained were good. In the last-mentioned State the detritus deposited by the floods proved very fertile during the first year of its existence. In the remainder of the Peninsula crops were somewhat below the average of the last decade. Drought in the planting season was an important factor adversely affecting the crop. This was followed by deep water at the time of transplanting and by rains in March and April, the latter damaging the standing crop before the late harvest could be reaped.

In the 1928 planting season the weather was again very dry and planting operations were much delayed, notably in Province Wellesley and Krian. Once established, however, the crops made favourable progress so that prospects at the end of the year were fair, provided that the late harvest could be reaped without serious damage by rain.

7. PRICE.—The prices realised for the padi crop during 1928 averaged about 15 cents per gantang.

8. SELECTION WORK.—Pure line selection work was maintained at Titi Serong along the lines already laid down. Further progress was also made in the selection of high yielding strains of the local varieties Nachin Puteh and Padi Siam at the Pulau Gadong Station in Malacca.

The selected Krian strains of padi continued to give satisfactory results in comparison with local varieties in many parts of the Peninsula, reports of increased yields varying from 25 to 50 per cent. being received from trial areas in Perlis, Kedah and Pasir Puteh district of Kelantan, as well as from the Federated States. Selected seeds have in most instances given crops which show comparative resistance to lodging under adverse weather conditions; which give better milling returns; and which shed less grain than crops grown from unselected seed. Certain selected strains of Radin are much appreciated by Malays for their flavour. In spite of their advantages, these selected strains are not yet so widely used as they should be, owing to the conservatism of the padi planters which leads them to view with suspicion any type of padi to which they are not accustomed. It is anticipated that this prejudice will gradually be overcome through the medium of demonstration stations and the instruction given by the increasing staff of Padi Inspectors.

9. MANURING AND CULTIVATION.—Manurial experiments were continued at the Stations in Province Wellesley, Krian, Malacca and Kuala Kangsar. Definite results are necessarily slow in materialising. The problem is complicated by wide variation in soil texture and in facilities for water control, as well as by the vagaries of the seasons in this country.

Analyses were made of the "total" and "available" phosphorus in soil samples from Talang Station, Kuala Kangsar. As a result it was found that while "total" phosphorus showed no significant increase, even on the plots which had received phosphatic manure for 10 years, there was a clear increase in "available" phosphorus on these plots.

Cultivation experiments have been continued, more particularly in Krian and Malacca, but the effects of different forms of cultivation are so frequently masked by seasonal conditions that progress is slow and no definite conclusions can yet be drawn on which specific recommendations can be based.

10. RICE STORAGE EXPERIMENTS.—Periodical determinations have been made of the moisture content of rice stored under varying conditions. The results shew a definite increase in the moisture content of the material with the arrival of the wet season. This investigation is being continued.

11. PESTS AND DISEASES.—Padi Fly (*Leptocoris acuta*). This pest appeared in large numbers in the Senaling Valley in Kuala Pilah district but was successfully controlled by means of an organised campaign carried out by the local population. On the orders of the District Officer a number of local padi growers assembled twice a week armed with home-made pieces of apparatus, resembling long-handled fans, or tennis racquets, dipped in a mixture of keruing oil (obtained from *Artocarpus* sp.) and wild rubbers such as Jelutong. By means of such apparatus gangs working under the supervision of officers of this Department caught the insects in large numbers and saved the padi crop from serious damage.

Scotinophora coarctata.—This Pentatomid bug, known locally as "Kutu Bruang" or "Bena Kura", was present early in the season in various localities throughout the Peninsula where the water on the fields was insufficient. In some instances much damage was done, but in others the pest was controlled either by the advent of heavy rains, or by flooding the fields where a water supply was available.

The Delphacid, *Sogata pallescens*, again appeared in several parts of the padi area in Krian in conjunction with the Jassid, *Nephotettix bipunctatus*, and was also present at Kajang Paya in Selangor. Attacked plots were drained of water and kept

dry for several days and the pest quickly disappeared. Stem borers, such as *Diatraea auricilia* and *Schoenobius bipunctifer*, though, as usual, almost universally present, only caused serious damage in a few localities, most of which were in Selangor.

12. RAT CAMPAIGNS.—The rat campaigns in Krian and Province Wellesley were continued energetically throughout the year. In Krian 904,644 rats were destroyed as compared with 842,791 in the previous year. That the campaign is having a useful effect is evidenced by the fact that practically no damage to the growing crop had been recorded at the close of the year. The total cost of the campaign amounted to just under two cents for each rat destroyed. In Province Wellesley 509,151 rat tails were collected, the total expenditure working out at 1.785 cents a tail. While the campaign in the Province has not yet been in operation long enough to achieve the maximum results, padi growers are generally of the opinion that it has already greatly reduced damage by rats.

The possibility of starting similar campaigns in other districts where rat damage is at present extensive is under consideration.

13. GREEN DRESSING EXPERIMENTS ON SLIMED LAND.—*Tephrosia candida* and *Mimosa invisa* continued to make good growth on the plots established on dredged and reslimed mining land at Kamunting in Perak. *Crotolaria anagyroides* did not prove equally vigorous and the plots on which it was planted became covered with lalang grass and various wild bushes. Consequently these plots were cleaned up and replanted with the *Crotolaria* towards the end of the year. The object of these plots is to test the effect of the different leguminous plants in restoring the fertility of the soil for padi cultivation.

COCONUTS.

14. AREA.—It is estimated that the total area now planted with coconuts in Malaya is approximately 520,000 acres, representing an increase of about 3 per cent. since the year 1924. About three-quarters of the planted area is believed to be made up of small holdings.

15. MARKETS.—The Singapore market price for copra, which at the end of 1927 was \$11.50 per picul (133½ lbs.), opened in January, 1928, at \$11.90, around which price it stood until the end of the month. Thereafter the price was maintained between \$11.50 and \$11.35 until the end of May. It subsequently declined to \$10.10 at the end of August and then varied between this figure and \$10.60 closing at the end of the year at \$10. The average price for the year was \$10.90 as compared with \$11.17, \$11.80 and \$11.95 in 1927, 1926 and 1925 respectively.

16. EXPORTS.—The exports of copra from the Federated Malay States for the years 1925 to 1928 are shown in the following table:

State.	Quantity in tons.				Value in dollars.			
	1925.	1926.	1927.	1928.	1925.	1926.	1927.	1928.
Perak	40,007	44,542	39,499	45,451	7,830,274	8,905,033	6,862,402	7,535,319
Selangor	15,426	16,963	14,120	20,148	2,909,119	3,212,553	2,615,641	3,435,968
Negri Sembilan...	2,236	3,417	3,302	2,251	463,494	575,451	562,528	381,675
Pahang	315	907	615	654	57,412	158,733	102,255	106,746
Total F.M.S. ...	57,984	65,829	57,536	68,504	11,260,299	12,851,770	10,142,826	11,459,708

Of the total for 1928, 20,486 tons were exported direct to foreign countries and 48,018 tons to the Straits Settlements.

The nett exports of copra and coconut oil from Malaya during the last three years were:

Year.	Copra.			Oil.		
	Quantity. Tons.	Value. Dollars.		Quantity. Tons.	Approx. copra equivalent.	Value. Dollars.
1926	104,653	21,852,330	...	8,458	14,000	3,090,953
1927	86,649	16,562,493	...	10,242	17,000	3,448,057
1928	95,091	18,747,129	...	9,828	16,400	3,168,881

17. GENERAL.—Whereas the crops for 1927 were below average, those for 1928 were satisfactory in most districts. The improvement in crop is partly responsible for the increase in exports, although an increase in the producing area is also a contributing factor, more especially in Perak, Selangor and Johore.

Data have been compiled from 30 representative estates in Malaya, which show that the average production of copra per acre from estates under European management is 8.73 piculs (1,162 lbs.) and that 251 nuts are required to produce 1 pikul (133½ lbs.) of copra.

Statistics have also been collected with reference to dwarf coconuts. These show that under fair average conditions and with good management eight-year-old dwarf palms have given an average production of 11.68 piculs of copra per acre. One estate has produced 19.29 piculs per acre over an area of 100 acres, but this is exceptional. Under favourable conditions dwarf coconuts, especially the yellow variety, have not proved as robust as tall palms, but where conditions are good the green dwarf is a sound proposition.

The data collected also show that there is a seasonal variation in output of copra per acre amounting to about 15 per cent. of the average crop.

18. **EXPERIMENTAL INVESTIGATIONS.**—The information obtained from the records of individual yields from 471 trees, growing under average estate conditions, during a period of eight years, may be summarised as follows:

- (1) The co-efficient of variability of an average population is as much as 34 per cent. of the mean production per palm.
- (2) Variability in cropping per palm per annum ranged from 5 to 115 nuts.
- (3) Of an average population, 19 per cent. of the palms are not profitable in that they yield under normal treatment less than 40 nuts a year.
- (4) Fifteen per cent. of the palms produce 24 per cent. of the total crop.
- (5) Poor yielders remained poor yielders, while good yielders were constant to that character.

Data have also been compiled which show that the copra content of nuts from different palms of the same variety varies from 79 to 131 per cent. of the mean copra production per nut. Further data regarding variation in the oil content of copra from different palms and seasonal variation in oil content of copra from the same palms, are in process of compilation.

The Coconut Experimental Station at Klang has been maintained in good condition and the general growth of the palms is satisfactory. The manurial, cultivation and catch crop experiments are also being maintained on this area.

Manurial experiments on mature coconuts have been commenced on an estate block of 18-year old palms of which the individual yields are known for the last eight years.

The flowering and fruiting characters of three races of dwarf palms were recorded for the fourth year in succession and will be published in the near future.

A scheme for instituting research work on the preparation of copra has been approved and the Empire Marketing Board has undertaken to contribute a half share of the provision made for this work. In the meantime preliminary chemical investigations connected with this scheme have been commenced. Several analyses of copra from different estates have been carried out, as a result of which it appears that the oil content of estate copra, calculated on a moisture free basis, varies from 64 to 67 per cent.

19. **DISEASES AND PESTS.**—The situation with regard to the complicated problem of palm diseases in Malaya has been considerably clarified. A general account of the whole of the palm disease investigations was published in the *Malayan Agricultural Journal* Nos. 9 and 10 of Vol. XVI.

EFFECTS OF LIGHTNING.—Supporting evidence has recently been obtained which clears up the position with regard to bud-rot due to lightning, and shows that lightning is a factor of importance in the causation of palm diseases, more especially on estates of tall coconuts. Small clumps are often struck with the result that two or three palms in the centre are killed and exhibit symptoms resembling those of bud-rot, while from 8 to 12 of the surrounding palms are slightly damaged, having their leaves broken or discoloured at the tips. These findings are of importance since, when considered in conjunction with other evidence, they strengthen the probability that no definite form of epidemic bud-rot exists in Malaya. They also help to simplify the general problem of palm diseases by removing from the field of investigation certain phenomena which tended to complicate it.

THE GREATER COCONUT SPIKE MOTH (*Tirathaba rufivena*).—Work on this pest has been continued and it has now been confirmed that the removal of the sheath just before it opens results in an increase in the percentage of nuts remaining on the spike. The value of this method of treatment depends on economic considerations but, since only 30 per cent. of the original female flowers reach maturity, it is probable that even a small increase in this percentage would render such treatment profitable.

Records made in the course of this investigation show that the fall of immature nuts reaches its maximum in the fifth or sixth week after the sheath has burst and that there is a slight secondary nut-fall in the eleventh to fourteenth weeks. All the factors influencing nut-fall have not yet been determined.

Setora nitens.—An outbreak of this Limacodid was reported on an estate on the Bernam River and later in the year on several estates in Lower Perak district. At first only the leaves of young palms were attacked, but later older palms in bearing became infested. Control measures recommended were hand-picking caterpillars and pupae, spraying young palms with lead arsenate solution, and encouraging the spread of a Tachinid parasite. This last measure is achieved by the use of special cages containing a number of pupae of *Setora* and so constructed as to allow the adult flies emerging from parasitised pupae to escape, while the moths emerging from healthy pupae are retained for destruction.

Artona catoxantha.—An outbreak of this moth in Singapore Island was reported in October, but it disappeared again during wet weather in November. Two other outbreaks on the South Coast of Johore were controlled by the parasites of the pest.

A number of interesting observations on various insects found feeding on different parts of the coconut palm are recorded in the annual report of the Entomologist.

OIL PALMS.

20. GENERAL.—Satisfactory progress has been made in the development of the new oil palm industry during the year, both in production of crop and in extension of the planted area.

21. AREAS CULTIVATED.—Statistics collected by this department show that there are now 25 estates possessing areas of land planted with oil palm, as compared with 24 in 1927, and that these planted areas now amount to 24,730 acres, as compared with the revised estimate of 19,755 acres in 1927.

The reserve land held by oil palm estates is estimated at over 25,000 acres, while an additional area of 25,000 acres represents alienations of land on which planting operations have not yet been commenced.

22. EXPORTS.—The annual exports of oil palm products from Malaya during the last three years have been:

Year.	Palm oil.				Palm kernels.			
	Quantity.		Value.		Quantity.		Value.	
	Tons.		Dollars.		Tons.		Dollars.	
1926	...	726	...	254,165	...	180	...	36,708
1927	...	852	...	269,966	...	178	...	31,763
1928	...	1,460	...	384,954	...	261	...	43,475

Six estates were producing oil and kernels during the year. A further considerable increase in production is anticipated during 1929.

23. MARKETS.—The market prices for oil palm products have remained satisfactory and very steady throughout the year. Palm oil has sold at about £38 per ton and palm kernels at about £20 per ton. The Malayan oil on account of its purity has commanded a premium over market quotations.

24. EXPERIMENTAL INVESTIGATIONS.—Numerous experiments are being carried out at the Government Experimental Plantation, Serdang, in connection with the cultivation, artificial pollination, pruning and manuring of oil palms. Variation studies of individual palm fruits were continued.

Determinations of the percentage of oil in fruits at varying stages of ripeness show that the maximum oil content is not developed until the fruits have reached full maturity. They also show that storing the ripe fruits after harvesting produces no real increase in their oil content, the apparent increase being due to loss of moisture from the fresh fruit and the consequent decrease in the weight on which the percentage of oil is calculated.

Comparisons of factory methods indicate that, as regards the treatment of the whole fruit, the efficiency of the centrifugal process, adopted in Malaya, compares favourably with that of the press system as employed in Sumatra. The oil obtained by the centrifugal process contains only a relatively small amount of sludge and can therefore be purified with a loss of oil that should not exceed 0.1-0.2 per cent. of the total quantity recovered from the centrifugal extractor.

The question of the increase of acidity of palm oil on storage has been studied. It has been found that with oil of average quality the increase should not exceed 0.1 per cent. a month, the acidity being calculated as percentage of palmitic acid.

An investigation regarding the increase in the iron content of oil stored in an iron drum shewed that there was no increase after three months. This work was undertaken in view of the probability that oil will be shipped in tanks in the near future.

Advice has been given on various points that have arisen during the working of estate factories.

The department's publication entitled "The Oil Palm in Malaya" has been much in demand and has aroused considerable interest in the possibilities of this crop in Malaya.

25. DISEASES AND PESTS.—Considerable damage to ripe fruits has been caused on estates in Selangor by a fungus named by the Mycologist, *Marasmius palmivorus*. This fungus was more commonly found in damp areas than in dryer situations. Close planting and insufficient pruning increase the humidity and favour its growth. On palms where the decaying, non-pollinated bunches were not removed and other debris was left lying on the ground, the fungus vigorously attacked the mature fruit bunches, itself fruiting profusely and apparently spreading rapidly. This disease seems liable to cause serious loss if attention is not paid to pruning and the removal from the palms of all debris.

Other diseases examined include a stem-rot, with which white ants and a fungus *Thielaviopsis* sp. were associated, and a root disease showing the presence of a species of *Ganoderma*. Attention has also been directed to a possible disease of maturing fruit bunches characterised by the fact that some nearly ripe fruits fall, or that individual fruits, while still unripe, can be easily removed from the bunch.

Insect pests have not been in evidence, though the leaf eating caterpillars of *Setora nitens* caused trouble on one estate and *Oryctes rhinoceros*, the black beetle of coconuts, was responsible for boring the bases of the leaf stalks.

MINOR CROPS.

26. STATISTICS.—The areas planted with minor crops in the Federated Malay States, the Straits Settlements, Johore and Kedah are approximately as shown in the table given in Appendix C.

A.—FOOD CROPS.

27. TAPIOCA.—Johore (14,000 acres) and Kedah (5,000 acres) remain the principal States in which this crop is now grown. The cultivation of tapioca shows a gradual decline, other crops, especially pineapples and coffee, receiving more attention than tapioca as catch crops with rubber on newly opened land. Imports were 7,285 tons valued at \$795,986 and exports were 28,223 tons valued at \$3,884,893. These figures show a decrease in imports of 800 tons and in exports of 6,916 tons as compared with those for 1927. The average market prices of "pearl" and "flake" tapioca for 1928 were about \$8.80 and \$8.50 per picul, respectively. The prices of both grades showed some decline during the year.

Investigations to determine the effect of tapioca cultivation in relation to soil impoverishment have been continued, but have not yet reached completion. The results of associated work on methods for sampling a standing crop and on a method for the rapid estimation of small amounts of phosphate were published in the *Malayan Agricultural Journal*, Vol. XVI, page 59.

Work has been undertaken in factories to determine the efficiency of the method of manufacture at present in use. The results indicate that only about half the total quantity of starch is extracted from the tubers and that there is, consequently, considerable room for improvement in the efficiency of the extraction process.

A series of experiments has been commenced to determine the changes in the carbohydrate content of the tuber as it reaches maturity.

28. MAIZE.—As anticipated, considerable difficulty was experienced in maintaining the selected strains of yellow flint maize which had been inbred for five generations. Numerous crosses were made between them during the year and further crosses will be made, with the object of obtaining strong growing and heavy yielding types of this local variety.

29. SOYA BEAN.—Continued selection experiments gave promise of useful results. The best strains were those derived from two varieties, of which one was originally obtained from Siam and the other was originally imported by Chinese agriculturists and grown for some years in Pahang. Several strains of each of these varieties are being multiplied at the Government Experimental Plantation, Serdang.

B.—FRUIT.

30. PINEAPPLES.—The area under this crop and the export of canned pineapples have been well maintained during the year. In Johore, where most of the fruit is now grown, three new factories were in course of erection. These will bring the total in Johore up to nine factories, while there are five others operating in Singapore and one in Selangor.

The following have been the exports of canned pineapples from Malaya during the last three years:

	1926.	1927.	1928.
Weight in tons	40,634	40,134	46,400
Value in dollars	7,669,784	8,296,656	8,421,230

The United Kingdom is the principal consumer of Malayan canned pineapples, taking about 80 per cent. of the exports and offering a good market for fruit of reasonable quality at a moderate price.

With the help of the Empire Marketing Board and the Malay States Information Agency, exhibits of Malayan (Singapore) canned pineapples were staged at the British Industries Fair in London, the Canadian National Exhibition in Toronto and the Imperial Fruit Show in Manchester.

These exhibits attracted considerable attention. Recent communications have, however, emphasised that, if Malaya is to obtain the full benefit of the excellent facilities thus afforded for bringing this commodity to the notice of the consumer and to be enabled successfully to face competition on the British market, the different grades of the product must be carefully standardised.

This important aspect of the industry was discussed at an informal meeting of packers and exporters with Mr. E. M. H. Lloyd of the Empire Marketing Board held in Singapore on the 2nd May, 1928. At this meeting both sections of the industry were able to exchange views and to learn from Mr. Lloyd the methods successfully employed in other countries for standardising similar agricultural produce.

Further investigations are being undertaken by this department with a view to consolidating the position, which the Malayan product holds on the United Kingdom market and to extending the demand to other parts of the Empire.

31. BANANAS.—Considerable areas of this crop are established in Negri Sembilan as a sole crop, and in Selangor, Perak, the Settlement of Penang and Kedah as a catch crop usually with young rubber. All the produce is sold inside Malaya.

The study of banana diseases and of the relative immunity to these of the numerous local varieties of banana has been continued in an endeavour to obtain varieties immune to Panama disease. As mentioned in previous reports this study is of considerable importance from an Imperial point of view and is being undertaken in co-operation with the Royal Botanic Gardens, Kew, and the Imperial College of Tropical Agriculture, Trinidad.

A full review of the year's work is contained in the annual report of the Mycologist. It will suffice to state here that the two local varieties, which give good promise of conforming to the requirements of the European market, namely, *Pisang Embun* and *Pisang Restali*, have been proved to be susceptible to Panama disease; and that this disease has been found in three small areas of land in different parts of the Peninsula.

A local bacterial wilt disease of bananas, similar to that occurring in Trinidad, is also being fully investigated.

32. OTHER FRUITS.—The mid-season fruit crop was satisfactory throughout the country, but that at the end of the year, owing to unfavourable weather conditions, was of poor quality generally and was also in most places limited in quantity.

Studies of the insects attacking fruits and fruit plants have been continued. Special attention has been given to pests of citrus trees and fruits and spraying experiments with various insecticides have been commenced on the area of lime trees at the Government Experimental Plantation, Serdang. Details are given in the annual report of the Government Entomologist.

C.—BEVERAGES.

33. COFFEE.—There has been increased interest in coffee cultivation during the past two years, many enquiries regarding this crop having been received from planters and owners of small holdings. There is still, however, scope for a considerable increase in the planted area to meet the demand of the local market alone, apart altogether from the probability that the produce would find a ready market abroad.

In connection with coffee cultivation measures for the control of two important pests should be taken into account. One is the well-known hawk moth, *Cephanodes hylas*, so prevalent on the old coffee estates in Malaya before the advent of rubber, and still responsible for serious damage, as was proved on an area of coffee in Johore during the year. The other is the coffee berry beetle, *Cryphalus (Stephanoderes) hampei* known in Java as "boeboek". This beetle was imported into Java from the Congo and has been introduced into one or two estates in Selangor. As, however, its distribution in Malaya is apparently limited, precautions are necessary to prevent its spread into new areas, especially when supplies of seed are being ordered from sources in Malaya or in Java.

34. TEA.—Widespread interest has been evinced in the possibility of cultivating both the upland and lowland types of this crop on a plantation scale in Malaya. This interest has in a few instances taken material shape. A lowland plantation of young tea is already in existence in Kedah, while preparations are being made for developing another considerable lowland property in Selangor. An extensive area of land in the main range of hills, not far from Cameron's Highlands, has been alienated for the cultivation of this crop and one or two other enterprises in the hills are contemplated.

Experienced planting opinion is divided as regards the probable relative merits of the upland and lowland types for local cultivation. While better labour and transport facilities in the plains at present favour the lowland type, the development of plantations in the hills would before many years eliminate these advantages, so that the better market prospects for the upland product tend to a consensus of opinion in its favour.

While the results obtained from privately owned experimental areas in the lowlands and from the Department's Experimental Plantations at Serdang and at Cameron's Highlands are encouraging, further work has yet to be done before it is definitely proved that tea cultivation can be established on a sound commercial basis either in the lowlands or in the hill country of Malaya.

D.—FIBRES.

35. SISAL HEMP.—The results of experiments with sisal hemp, carried out at the Government Experimental Plantation, Serdang, have shown that it is possible to obtain a yield of fibre of fair average quality representing about 4.5 per cent. of the weight of the mature fresh leaves. This may be considered a very satisfactory figure.

Experiments in the harvesting of leaves at different intervals of growth have not so far revealed any great differences in either the quality or the strength of the fibre, whether the leaves are cut at intervals of two, four or six months.

E.—MISCELLANEOUS CROPS.

36. ARECA NUTS.—Production has in general been well maintained and an increased output is reported from Johore, where comparatively large extensions have recently been made in the planted area. Prices have, however, continued to decline, the average declared value per ton of exports being \$206 in 1927 as compared with \$178 in 1928. The average annual excess of imports over exports during the last four years has been about 20,500 tons, of which the corresponding average value has been approximately 6½ million dollars. Greater care in curing and grading would benefit the local industry.

Records of yields of individual palms for selection purposes have been continued at Serdang. Other observations at Serdang show that in the case of young palms the proportion of dry split nuts is about 25 per cent. of the weight of the fresh fruit from which they were obtained.

37. TUBA.—*Derris elliptica*, M. (tuba puteh) and *D. malaccensis*, M. (tuba merah). The use of this root in the preparation of proprietary insecticides is gradually being extended with a corresponding increase in the demand for the raw product.

The planted area in the Federated Malay States remains at about 700 acres, but that in Johore is estimated to have increased from 1,400 to 2,000 acres.

Experiments at Serdang have shown that there are considerable variations in the toxic content of the different varieties under cultivation, for example that known as "erect tuba", *D. malaccensis*, has a much bigger toxic content than *D. elliptica*, commonly known as "tuba puteh". Moreover the fine lateral roots have a higher toxic content than the large roots in all cases.

Determinations of the ether extract of roots of *Derris elliptica* have shown that this variety should be harvested approximately 23 months after planting, the amount of toxic substance in the ether extract reaching a maximum about this period. Subsequently the toxic content declines until eventually the root becomes unsaleable.

38. CHAULMOOGRA OIL.—A further experimental area was planted up at Serdang during the year with *Hydnocarpus anthelmintica* and *Taraktogenos Kurzii*, and an additional supply of seed of *Hydnocarpus Wightiana* was received. The trees on the areas already planted have continued to make satisfactory progress.

Analyses of seeds of *H. anthelmintica* showed that the proportion of kernel was approximately 30 per cent. and that the kernel contained roughly 52 per cent. of oil, so that the oil content calculated on the whole seed was about 16 per cent.

A sample of the nuts of *Hydnocarpus anthelmintica* was provided for trial at the Leper Asylum, Kuala Lumpur. The Medical Officer in charge reported that the sample was of good quality and that no distinction could be drawn between the locally grown nuts and those obtained from Siam.

39. COVER CROPS.—Several new cover plants were introduced during the year, the most promising of which is *Tephrosia toxicaria*. This plant is very similar in habit to *T. candida*. Its roots are stated to contain a toxic principle similar to that occurring in tuba root.

Full information on the cultivation and uses of some of the more important cover plants and green manures was published in the *Malayan Agricultural Journal*, Volume XVI, No. 7.

STOCK.

40. GENERAL.—Measures for increasing the number of live stock in Malaya are receiving consideration, not only on account of the desirability of increasing the local production of fresh milk, meat, poultry and eggs, but also on account of the dependence of local rice production on the number of working buffaloes available.

At the present time Pahang is the State in which an increase in live stock is most urgently needed, because during the last five years disease, floods and improper feeding have taken a heavy toll of all domestic animals, especially buffaloes. While the destruction by the floods of a large number of sheep and goats is a serious loss to the inhabitants of the riverine areas, the mortality among buffaloes is of even greater importance, since the lack of draught animals for ploughing must inevitably be attended by a reduction in the area that can be properly cultivated for padi growing. To ameliorate the situation the Pahang Government is importing consignments of buffaloes, but these consignments are of necessity limited, so that a considerable period must elapse before the losses of the past few years can be replaced.

41. STOCK FARM AT SERDANG.—A further area of about 20 acres of land, reserved for the cattle farm, has been cleared of timber and planted with various grasses suitable for grazing.

A supply of dairy utensils together with a steam boiler for sterilising milk bottles was received at the end of the year.

The herd now consists of two mature and six young Montgomery bulls, eight mature Montgomery cows and four heifers, two Ayrshire heifers and one Jersey bull. Additions made during the year included two Australian Ayrshire cows with two heifer calves kindly presented by H.H. The Sultan of Johore, together with four cows and one bull of pure Montgomery breed imported from India.

The four Ayrshire animals and the Jersey bull contracted red water fever (Piroplasmosis) and in spite of special care the two Ayrshire cows succumbed to its effects. The Jersey bull and the Ayrshire heifers appear, however, to be recovering.

While the Ayrshire and Jersey stock are not too well suited to conditions in the plains of Malaya, the Montgomery breed has, up to the present, done well at Serdang. It is hoped that crosses of the two former breeds with the Montgomery cattle will produce animals well adapted to local conditions in the plains, but capable of giving a more continuous and possibly more plentiful supply of milk than do the pure bred Montgomeries.

SOILS.

42. SOIL TYPES.—On the establishment of the Division of Soils and Plant Physiology in 1927, the most urgent problem appeared to be that of systematics of soils, that is, the establishment of soil types and the relating of these types to the underlying parent material.

For this purpose it was decided to carry out a detailed soil survey of a limited and accessible area in Selangor, extending from Cheras through Serdang, along the Klang valley to the coast, since this area includes all the important geological formations on the west side of the Peninsula.

Much time has been given to the continuation of this survey which has now reached the low-lying areas around Klang. In all 426 samples representing 111 profiles were taken and their pH values and mechanical analyses completed.

The characteristics of three inland soil types, namely, those derived from quartzite, the phyllites of the Raub series (locally known as laterite) and granite have been provisionally determined, subject to confirmation by sampling a number of similar geological areas in different parts of the Peninsula. No simple relationships have been found for alluvial soils in the area under survey.

43. **PADI SOILS.**—Five hundred and seventeen more samples were received from the Field Division: all have been subjected to mechanical analysis and pH determination.

Results definitely confirm the observation recorded in the report for 1927, that a medium or even high percentage of sand in the soil does not necessarily result in a low yield of padi. Consequently it would appear that an area otherwise suitable, especially as regards water supply and population, need not be rejected for padi growing merely because its soil has a fairly high sand content.

The results of 100 analyses of padi soils have so far shown no correlations between padi yields and soil factors, such as phosphorus content (either total or available), acidity, percentage of organic matter, or ammonification when flooded. This though disappointing, is perhaps not surprising in view of the reductions in yield caused by a large number of interfering factors not connected with the soil, such as attacks by birds and animals, inadequate cultivation and most important of all, lack of water control.

A series of fifty experimental tanks have been constructed at Serdang in which various factors likely to influence the growth of padi can be studied under strictly controlled conditions of soil and water supply.

44. **OTHER SOIL INVESTIGATIONS.**—A preliminary series of pot culture experiments has been conducted with ragi planted in soils of the three inland types mentioned above and treated with various green and artificial manures. These experiments suggest very strongly that, when attention is turned to crops other than relatively slow growing trees such as rubber, the inland soils of Malaya will not be found to possess any peculiar richness exempting them from the world-wide need for treatment with suitable forms of manure.

Finally certain methods of analysis used in soil investigations have been critically examined.

MISCELLANEOUS INVESTIGATIONS.

45. In addition to the research work already indicated in connection with the crops mentioned above, various other problems received attention, among which the following may be mentioned:

46. **CHEMICAL INVESTIGATIONS.**—The investigations relating to the preparation, deterioration on storage and moisture content of *jelutong* have enabled a marked improvement to be effected in the quality of the Malayan product and have led to its increased use by American manufacturers of chewing gum, in consequence of which the exports increased from 576 tons in 1927 to 1,002 tons in 1928.

The results of the investigation on the production of alcohol (*samsu*) from rice were published in the *Malayan Agricultural Journal*, various suggestions being made with a view to increasing the efficiency of the present process employed by the local Chinese producers.

47. **MYCOLOGICAL INVESTIGATIONS.**—The investigation of local diseases caused by species of *Phytophthora* and comparative studies of the Malayan species of this genus with those occurring in other tropical countries were almost concluded by the end of the year. The results show that several species of *Phytophthora* are directly responsible for Black Stripe disease and Patch Canker of the rubber tree (*Hevea brasiliensis*).

The species concerned in Black Stripe disease are *Phytophthora palmivora* Butl. (rubber group), *P. meadii* McRae and *P. heveae* Thompson (a new species).

In the case of Patch Canker of rubber tree fungi, *P. palmivora*, a *Phytophthora* allied to *P. meadii*, and a species of *Pythium* have been found on different occasions to be responsible.

While outbreaks of leaf-fall and pod-rot of rubber such as occur in other countries have not been recorded in Malaya, a few cases of a pod-rot have been observed and have been found to be due to *Phytophthora heveae*.

In addition to the above species, isolated from actual cases of diseased *Hevea* bark and fruits, a number of other species of *Phytophthora* have, in the course of this investigation, been proved capable of attacking rubber trees and of producing

similar effects. These latter species were isolated from diseased portions of roselle and sireh plants in Malaya and of coconut, castor oil, tobacco and cotton in other tropical countries.

The local disease of sireh has been proved to be caused by *Phytophthora colocasiae* Rac. and that of roselle by a strain of *P. parasitica* Dast.

48. ENTOMOLOGICAL INVESTIGATIONS.—Information concerning the identity, life history and animal parasites of a number of pests of major and minor economic crops, ornamental plants and stored produce in Malaya is being steadily accumulated. The additions to these records made during the past year are summarised in the annual report of the Entomologist.

GENERAL.

49. GOVERNMENT EXPERIMENTAL PLANTATION, SERDANG.—The area now opened on this plantation is approximately 800 acres, which includes a reserve of about 25 acres for the proposed Agricultural School and about 30 acres of roads and building sites, the balance of about 745 acres being planted with various economic crops, fodder and pasture grasses. An excellent system of roads has now been completed giving easy access to all the experimental plots.

A site was prepared for the erection of an experimental oil palm factory and orders were placed for the necessary machinery. It is anticipated that the plant will be in use by the middle of 1929.

The necessary equipment for manufacturing tea on a small scale was received at the end of the year.

The main lines of work in progress have been indicated in the earlier portions of this report. Detailed information is given in the annual report of the Agriculturist.

50. EXPERIMENTAL PLANTATION, CAMERON'S HIGHLANDS.—Further progress has been made in the development of this plantation. Of the 76 acres previously felled and partially cleared of timber 50 acres had been stumped and terraced ready for planting at the end of the year and a further four acres on the banks of the Bertam River, had been opened up for the planting of fodder grasses. In addition a small area of jungle was cleared of undergrowth and thinned out for planting such crops as cinchona and cardamoms under partial shade.

Plots planted included $5\frac{1}{2}$ acres of different varieties of tea, $5\frac{1}{2}$ acres of various fodder grasses and one acre of *Axonopus compressus* for grazing, three acres of Arabian coffee and three acres of cinchona.

The nursery area was extended to rather more than two acres. The beds were well stocked with planting material of numerous economic plants, including about 50,000 seedlings of Assam tea and 10,000 Arabian coffee seedlings.

In addition to the considerable number of economic plants already introduced on the plantation, a collection of vegetables and ornamental plants is being assembled from various countries, more especially England and Australia.

The crop plucked from the original plot of Assam tea during its third year growth gave a calculated yield of 516 lbs. of dry tea per acre per annum.

The Arabian coffee planted out in November, 1927, has so far shown excellent growth and appears to be well suited to the conditions on the Highlands.

The growth of the cinchona plants has been very irregular. A number of the young plants suffered from the effects of mosquito blight, but have shown a strong tendency to recover.

Cut worms (*Rhyacia ypsilon*) have continued to cause damage to vegetable crops and young seedlings in the nursery. A few other pests and diseases have also made their appearance, but have not yet caused any serious damage.

51. FRUIT DISTRIBUTION AND DEMONSTRATION STATIONS.—As stated in last year's report small fruit stations to supply planting material of good quality and to serve as demonstration plots have been established at Kuala Kangsar and near the quarters of the Agricultural Field Officers in Kuala Lipis, Seremban and Malacca. These stations have been maintained in good order and additions have gradually been made to the stocks of trees, as reliable planting material has become available. Cultivation and drainage received attention where necessary and cover crops were planted.

52. DISTRIBUTION OF PLANTING MATERIAL.—The demand for planting material increased considerably and large quantities were distributed throughout the whole Peninsula. There were in all 981 applications of which a number were received from foreign countries.

The planting material mostly in demand included seeds of oil palms, coffee and cover plants, cuttings of sweet potatoes, tapioca and guinea grass and seedlings of local fruit trees.

The Field Division distributed 9,449 young fruit trees to small holders in Pahang in areas where the majority of mature fruit trees were destroyed by the floods at the end of 1926.

Selected seed of padi distributed throughout the Peninsula amounted to 14,900 gantang.

53. AGRICULTURAL SHOWS.—The Malayan Agri-Horticultural Association held its sixth annual exhibition at Ipoh from August 3rd to 6th. The department prepared its usual special exhibit, of which the special feature was a collection of food plants from Serdang.

Successful district shows were held at Malacca, Taiping and Teluk Anson. At the two latter the exhibits of fruits and vegetables were noticeably good in quantity, quality and variety. At Taiping competition in the padi section was keen and aroused much interest.

54. LECTURES.—Papers on "The Cultivation of Oil Palm in Malaya" and on "Nipah Palm" were prepared and read by Mr. Bunting and Mr. Dennett, respectively, at the Conference of the Incorporated Society of Planters held at Port Dickson at the end of July. Mr. Bunting also gave a lecture entitled "Permanent Crops Other Than Rubber" to the Central Perak Planters' Association in Ipoh on the 30th October. The Agricultural Field Officer, Pahang East, delivered lectures at the Pekan and Kuantan clubs on the subject of garden soils.

55. TRAINING OF MALAY OFFICERS.—At the beginning of the year there were 13 first-year and nine second-year apprentices in training at the department. Six of the second-year apprentices passed the necessary qualifying examination held in April and were promoted to the grade of Junior Agricultural Assistant, four assuming duty in the Federated Malay States and two in the Colony.

Eleven of the first-year apprentices proceeded to the second-year course after the April examination and 15 new officers were appointed in May. One of the latter became seriously ill, so that at the end of the year there were 25 students in training, eight being officers of the Unfederated States.

A Conference of Malay Officers was held at Head-quarters from the 26th to the 28th January inclusive.

Three examinations for Junior Agricultural Assistants to qualify for promotion to the rank of Senior Agricultural Assistant were arranged during the year. Of five candidates only one satisfied the examiners.

56. SCHOOL OF AGRICULTURE.—The plans and estimates for this school were further considered and revised during the year. Sums of \$75,000 and \$20,000 were entered on the 1929 Estimates of the Federal and Colonial Governments, respectively, as first votes for the buildings.

The site selected at Serdang was maintained in good order. A site for the Principal's house was levelled and an access road thereto commenced. Schemes for supplying light and water to the school and the Experimental Plantation were receiving consideration at the end of the year.

The Advisory Committee for the school met on the 19th December, 1928.

The offer of a scholarship to be called the "Edwin Philips" Scholarship was gratefully accepted.

57. SCHOOL GARDENS.—As usual implements, fencing and planting materials have been supplied to school gardens. Members of the staff have carried out routine inspections and have acted as judges in several competitions.

While the gardens at individual schools in various parts of the country are well maintained and carefully tended, there is on the whole room for considerable improvement, both in the upkeep of the gardens themselves and in the use made of them for teaching purposes.

58. EXHIBITIONS.—With the aid of the Malay States Information Agency and the Empire Marketing Board an exhibit of oil palms and canned pineapples was staged at the British Industries Fair in London during February. Materials for a comprehensive exhibit of oil palms and canned pineapples, including a small model of an oil palm estate, were despatched for use at the Canadian National Exhibition held at Toronto during August and September. Finally, a very successful exhibit of canned pineapples combined with a demonstration of methods of cooking and using them was arranged at the Imperial Fruit Show in Manchester during October, 1928.

Exhibits of oil palm and tapioca have been forwarded to London for use at the British Industries Fair to be held in February, 1929.

59. PUBLICATIONS.—There was an increase of interest in the *Malayan Agricultural Journal*, particularly outside Malaya. The number of local subscribers increased by 12 to 140, whereas the foreign subscribers increased by 46 to a total of 118.

The demand for the Malay publication, *Warta Perusahaan Tanah*, has increased its distribution from 3,500 copies per issue at the end of 1927 to 5,000 copies per issue in the second half of 1928. In all 17,000 copies were distributed as compared with 12,000 in the previous year. Four quarterly numbers with thirteen illustrations were issued.

The *Chinese Agricultural Journal*, Volume II, was published in four quarterly parts each of 5,000 copies with twenty-one illustrations.

The Co-operative Societies Department and the Rubber Research Institute of Malaya have made use of the vernacular publications of this department for their propaganda work among Asiatics.

The steadily increasing amount of correspondence from Asiatic readers of these journals is evidence of their utility.

60. Distinguished visitors to the department have included in March Dr. A. W. Hill, C.M.G., F.R.S., Director of the Royal Botanic Gardens, Kew, and in April the Rt. Honourable Major W. G. A. Ormsby-Gore, P.C., Under Secretary of State for the Colonies.

KUALA LUMPUR,
11th June, 1929.

H. A. TEMPANY,
Director of Agriculture, S.S. and F.M.S.

APPENDIX A.

STAFF.

1. SECRETARY FOR AGRICULTURE.—Mr. F. W. South, Chief Agricultural Field Officer, was in charge of the department as Acting Secretary for Agriculture throughout the year.

2. ASSISTANT TO SECRETARY FOR AGRICULTURE.—Mr. D. H. Grist (Agricultural Economist) acted throughout the year in addition to his own duties. Mr. W. N. C. Belgrave was Editor of the *Malayan Agricultural Journal*.

3. CHEMICAL DIVISION.—Major B. J. Eaton, o.b.e., Agricultural Chemist, remained seconded to the Rubber Research Institute throughout the year.

Mr. R. O. Bishop, m.b.e., acted as Agricultural Chemist until the 4th of May when he proceeded to Europe on three months leave prior to resigning from Government Service. For the remainder of the year Major C. D. V. Georgi, o.b.e., acted as Agricultural Chemist.

ASSISTANT AGRICULTURAL CHEMISTS.—Mr. R. O. Bishop, m.b.e. (resigned on 5th August, 1928), Major C. D. V. Georgi, o.b.e., Mr. V. R. Greenstreet.

ASSISTANT ANALYST.—Mr. Gunn Lay Teik.

4. MYCOLOGICAL DIVISION.—Mr. A. Thompson acted as Mycologist until the 4th January on which date Mr. A. Sharples resumed charge of the Division on return from leave.

ASSISTANT MYCOLOGISTS.—Mr. A. Thompson, Mr. F. S. Ward, Mr. R. A. Altson (appointed on 13th April, 1928, and assumed duty on the 11th August, 1928).

5. ENTOMOLOGICAL DIVISION.—Mr. G. H. Corbett, Government Entomologist, was in charge of the Division throughout the year.

ASSISTANT ENTOMOLOGISTS.—Mr. H. T. Pagden (appointed on 15th December, 1927) assumed duty on the 14th January, 1928, Mr. N. C. E. Miller (appointed on 5th April, 1928) assumed duty on the 5th May, 1928.

6. DIVISION OF PLANT PHYSIOLOGY AND SOILS.—Mr. W. N. C. Belgrave (Plant Physiologist) was in charge throughout the year.

ASSISTANT CHEMIST (SOILS).—Mr. J. H. Dennett.

7. BOTANICAL DIVISION.—Dr. H. W. Jack (Economic Botanist) was in charge throughout the year.

ASSISTANT BOTANISTS.—Mr. W. N. Sands (on leave from 9th March, 1928, to 17th October, 1928), Mr. R. B. Jagoe.

8. AGRICULTURAL DIVISION.—Mr. B. Bunting was in charge throughout the year. Mr. F. G. Spring remained seconded to the Co-operative Societies Department.

ASSISTANT AGRICULTURISTS.—Mr. J. N. Milsum (on leave from the 6th April to the end of the year), Mr. E. A. Curtler, Mr. T. D. Marsh, Mr. J. Lambourne (on leave till the 8th March), Mr. J. L. Greig (appointed on 19th October, 1928, and assumed duty on 15th November, 1928).

HORTICULTURAL ASSISTANTS.—Mr. H. Ritchings, Mr. F. S. Banfield (transferred to Maxwell's Hill Gardens, Taiping, on the 27th December, 1928).

9. FIELD DIVISION.—Mr. F. Birkinshaw (Agricultural Field Officer) acted as Chief Agricultural Field Officer until his departure on leave on the 29th June, 1928, from which date Mr. A. E. Coleman-Doscas (Agricultural Field Officer) was in charge of the Division until the end of the year.

AGRICULTURAL FIELD OFFICERS.—These officers were distributed as follows:

Perak North.—Mr. F. Birkinshaw up to June 28th, inclusive; Mr. J. Fairweather from 1st July.

Perak South.—Mr. A. E. C. Doscas until the end of June; Mr. J. A. Craig from 1st July to 4th December; Mr. F. R. Mason from the 5th December.

Selangor.—Mr. C. L. Newman until the end of June; Inche Zebedin bin Datoh Sri Lela from 1st July to the 4th December; Mr. J. A. Craig from the 5th December.

Negri Sembilan.—Mr. W. H. Barnes (temporary Agricultural Field Officer).

Pahang West.—Mr. J. W. Jolly up to 5th April; Mr. R. G. Heath from 6th April.

Pahang East.—Captain J. M. Howlett, m.c.

Province Wellesley and Penang.—Mr. F. R. Mason to 5th April; Mr. J. W. Jolly from 6th April.

Malacca.—Mr. J. Fairweather to 30th June; Mr. C. L. Newman from 1st July.

Singapore.—The Acting Chief Field Officer in addition to his own duties to the end of June; Mr. C. L. Newman, Agricultural Field Officer, Malacca, in addition to his own duties from 1st July.

Johore.—F. de la Mare Norris was Principal Agricultural Officer until the 5th April, when he went on leave, and again on his return on the 1st December; Mr. F. R. Mason acted from the 6th April to the 30th November, inclusive.

10. ECONOMIC DIVISION.—Mr. D. H. Grist (Agricultural Economist) was in charge throughout the year.

11. AGRICULTURAL INSTRUCTION (MALAY OFFICERS).—Mr. G. E. Mann, M.C. (Agricultural Instructor, Malay Officers), was in charge throughout the year.

12. LIBRARY.—Mr. L. A. Rijk was in charge of the Library throughout the year.

13. The substantive appointments of Geneticist, Soil Bacteriologist, one Assistant Chemist, Second Superintendent of Government Plantations, and Agricultural Research Student in Botany were not filled throughout the year.

APPENDIX B.

SUMMARY OF PADI RETURNS—BRITISH MALAYA.

Year 1928=Season 1927-28 (Yield in gantangs of padi) (700 gts. padi=1 ton of rice).

State.	Wet.		Dry.	
	Acreage.	Yield.	Acreage.	Yield.
FEDERATED MALAY STATES.				
Perak	87,626	19,557,455	6,535	844,443
Selangor	13,060	1,669,077	3,579	558,449
Negri Sembilan	31,555	3,875,692	(included in wet)	
Pahang	21,995	3,733,004	7,803	805,436
Total F.M.S.	154,236	28,835,228	17,917	2,208,328
Krian	55,182	12,423,774	—	—

STRAITS SETTLEMENTS.

Singapore	—	—	—	—
Penang	5,060	2,170,700	—	—
Malacca	27,669	8,913,849	—	—
Province Wellesley	39,505	10,942,000	—	—
Dindings	600	180,000	470	127,500
Total S.S.	72,834	22,206,549	470	127,500

UNFEDERATED MALAY STATES.

Johore	3,275	390,181	3,774	854,513
Kedah	170,999	53,020,957	1,548	215,205
Perlis	32,645	5,434,400	—	—
Kelantan	175,312	18,826,980	60	7,200
Trengganu*	22,000	2,200,000	8,000	800,000
Total U.M.S.	404,231	79,872,518	13,382	1,876,918
Total F.M.S.	154,236	28,835,228	17,917	2,208,328
„ S.S.	72,834	22,206,549	470	127,500
„ U.M.S.	404,231	79,872,518	13,382	1,876,918
Total Malaya	631,301	130,914,295	31,769	4,212,746

* Estimated by inspection.

ACREAGE OF MISCELLANEOUS CROPS IN MALAYA.

17

